WARHEAD CAPACITORS:
CHARACTERIZATION OF ADVANCED CAPACITORS USED IN ELECTRONIC SAFETY AND ARMING DEVICES

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PRESENTATION OUTLINE

- Introduction / History
- Applications
- General Characteristics
- Electrical Characteristics
- Environmental Characteristics
- Physical Characteristics
- Reliability
- Conclusion

INTRODUCTION / HISTORY

- HV Electronics Systems
- HV Mica Paper Capacitors
- HV Low Inductance Mica Paper Capacitors
- HV Low Inductance Dual Dielectric Capacitors

APPLICATIONS

- HV Mica Paper Capacitors
  - HV Power Supplies
  - HV Transmitters
  - HV “EA” (ECM) Systems
  - Ignition Systems
  - Well Logging Equipment
- HV Low Inductance Capacitors
  - “Large” Mica Paper Capacitors
  - “Small” Dual Dielectric Capacitors

GENERAL CHARACTERISTICS

- Highly reliability for single pulse discharge
- Not intended for typical DC life applications
- Small volume
- Low inductance (3-7 nH)
- DFMA
- Dual dielectric system
- Extended foil construction
- Flat lead electrodes
- Polymer construction

ELECTRICAL CHARACTERISTICS

- Capacitance Range (0.03 to 0.50 uF)
- Capacitance Tolerance (+/- 10%)
- Voltage Range (2.5 to 6.0 kV)
- Dielectric Withstanding Voltage (115%)
- Dissipation Factor (see attached graph)
- Insulation Resistance (see attached graph)
- Thermal Coefficient of Capacitance (see attached graph)
- Inductance (3 to 7 nH)

ENVIRONMENTAL CHARACTERISTICS

- Operating Temperature (-55C to +85C)
- Thermal Shock
  - -55C to +85 C
    (MIL-STD-202, Method 107, T.C. A)
- Moisture Resistance
  - 99% of initial IR
    (MIL-STD-202, Method 106)
- Humidity Resistance
  - (MIL-STD-202, Method 103, T.C. B)

PHYSICAL CHARACTERISTICS

- Vibration
  - MIL-STD-202, Method 201
  - MIL-STD-202, Method 204, T.C. D
- Shock
  - MIL-STD-202, Method 213, T.C. I
- Solderability
  - MIL-STD-202, Method 208
- Resistance to Soldering Heat
  - MIL-STD-202, Method 210
- Terminal Strength
  - MIL-STD-202, Method 211, T.C. A&B
- Resistance to Solvents
  - MIL-STD-202, Method 215

RELIABILITY

- High Reliability
  - Probability of Charging
    - » Short term breakdown
    - » >0.999
  - Probability of Staying Charged
    - » DC Life
    - » >0.999 (one hour)
  - Probability of Discharging
    - » Pulse Discharge Life
    - » >0.999 (N pulses +1)
- Voltage Acceleration Factor
  - Approximately 9

CONCLUSION

High reliability, low inductance, dual dielectric capacitors provide outstanding characteristics when properly designed, manufactured, tested, and applied to Exploding Foil Initiators in Electronic Safing and Arming systems in missile warheads.